

# Future Focus

A career planner for Arkansas students

## Technology Rules

The future is now for careers in science, technology, engineering, and mathematics

- 25 exciting careers in science and engineering
- 7 steps to a career plan that works
- How Project Lead The Way jump-starts engineering careers
- Why women excel in science and math

And much more



# Dear Arkansas Student,

**W**elcome to a special edition of *Future Focus: A Career Planner for Arkansas Students*.



You may or may not have thought about your career plans, but right now is a good time to start. The courses you take in high school, your participation in student organizations, and your part-time jobs are all part of your preparation for a lifetime of rewarding work. No one expects you to set your plans in stone—in fact, it's likely that you will change careers several times in your work life—but one of the most exciting things about high school is the chance you get to begin shaping your own future.

This special edition of *Future Focus* is dedicated to the Science, Technology, Engineering, and Mathematics cluster of careers and can help you explore your options. It contains valuable information to help you plan your career, including advice on choosing your high school classes, descriptions of career clusters and pathways, and Web sites you can visit to find out more about preparing for your future.

It can also tell you a lot about careers in science, technology, engineering, and mathematics. There are many great opportunities in this area, and they are open to everyone with the talent and dedication it takes to succeed.

Think about the different jobs in science and technology, find out how much they pay and how much education you need to qualify for them, and talk to your teachers, counselors, and families about your choices.

Whatever you do, don't be afraid to think outside the box. If a particular career seems to be filled with people different from you in gender or background, that doesn't mean it can't be the right fit for you. After all, you are the one who will be putting in the hours on the job, so you need to choose a career you'll enjoy.

We believe this guide will help you do that, and we wish you the best of luck in all your life and career choices.

Sincerely,

The Arkansas Department of Workforce Education Staff



# Future Focus

A career planner for Arkansas students

## Your Future Is Now in Science and Technology

A career in science, technology, engineering, and mathematics is all about building the future. Scientific innovation is a cornerstone of America's prosperity. History shows us that revolutionary new ideas can transform the economy and generate millions of jobs. In a career in science and technology, you can be part of this important work and transform your own future as well. Opportunities are open for everyone with talent, regardless of traditional ideas of who can or can't excel in the field. Read on to find out what it takes to succeed in science and how you can start building your future now.

• • • • ATTENTION • • • •

### Share This Guide

*Future Focus* is written with you and your career search in mind, but you're not the only one who might be interested. Just as your parents, teachers, and guidance counselors are involved in the outcome of your career plans, they also need some of the information in this guide to help you with your choices. Read this edition of *Future Focus*, share your reactions with adults who care about your future, and ask them to take a look and see what they think. Career planning is a big job; make sure you have all the support you need.

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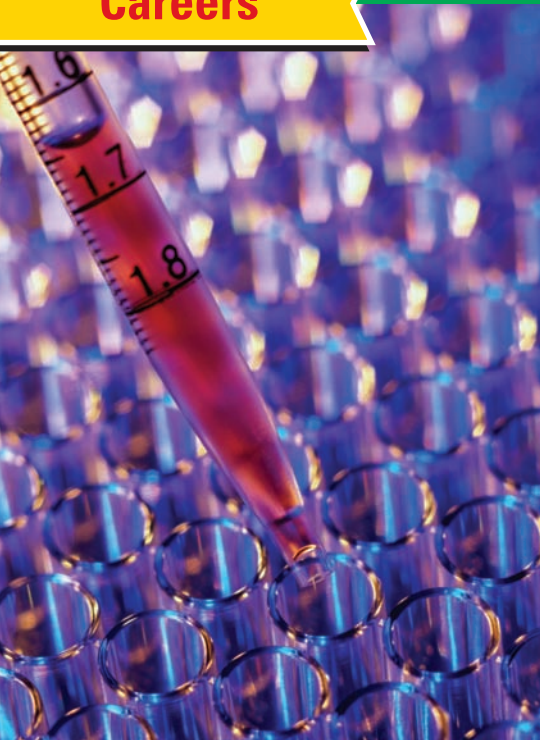
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## 10 Highest-Paying Science and Engineering Professions

Occupation	Salary in Arkansas
1. Engineer Manager	\$93,079
2. Astronomer	\$79,795
3. Conservation Scientist	\$78,178
4. Meteorologist	\$74,550
5. Nuclear Engineer	\$67,898
6. Environmental Engineer	\$66,584
7. Physicist	\$65,923
8. Chemical Engineer	\$65,885
9. Metallurgical/Materials Engineer	\$63,971
10. Aerospace Engineer	\$62,597

Based on median income per year in Little Rock, Arkansas, metropolitan area. Source: Salary.com (www.salary.com)

# You Can Connect With High Tech

*A career in science and engineering means exciting work developing the new ideas and technologies that make the economy grow.*

**W**hen it comes to the main factors leading to a strong economy, the one item on nearly every expert's list is

innovation. "Even in the industrial economy 100 years ago, the driving forces were discovery and new technologies," says John Ahlen, president of the Arkansas Science and Technology Authority.

"Today, the discoveries are coming out of laboratories. It's research by the major companies that leads to new software, pharmaceuticals, cars, and electronic devices," Ahlen says.

As new technologies arise, industries grow up around them, sometimes providing thousands of jobs. This inventive spirit has always been one of the best things America has going for it.

Unfortunately, the number of scientists, engineers, researchers, and inventors is not keeping up with the demand for them. Job growth in science and technology is about three times that of the average job, and pay is among the highest of any field. Fewer American students are pursuing those jobs though, which means that if you love science and math, your future could be bright.

While no big players in Arkansas dominate technology, the field is as important here as anywhere else. Small companies using new technologies tend to be where the most growth is, Ahlen says.

Lydia Carson, director of Arkansas Manufacturing Solutions, which offers technical advice to companies around the state, says variety is the hallmark of Arkansas' high-tech enterprise. "We don't have one industry that dominates," Carson says. "We've got a wide range."

Arkansas is moving to boost high-tech development. The University of Arkansas, in partnership with private companies, has



opened its \$6 million Research and Technology Park in Fayetteville to turn ideas bubbling out of university labs into money-making products.

Pamela Jansma, a geology professor at the university, says there's a big demand for Arkansas scientists. Her students have gone to work for environmental agencies, the government, and oil and mineral exploration companies.

"One person just took a job at the Pacific Disaster Center in Hawaii," she says. "At the moment, our students are not having trouble finding jobs." ●

# Are You the Tech Type?

*The Science, Technology, Engineering, and Mathematics cluster covers a lot of ground—and there could be a spot just right for you.*

In the Tom Hanks movie *Apollo 13*, three astronauts are trapped in space after a small explosion on their spacecraft. A toxic gas is escaping into their ship, slowly poisoning them.

At ground control in Houston, a team of scientists and engineers collects the same equipment that the astronauts have in their spacecraft and, racing the clock, build a filter from pieces of plastic, clothing, and duct tape. They then radio the astronauts to tell them how to build the device, and it saves their lives.

The movie, based on a true story, so impressed schoolgirl Lydia Carson that she made a career decision on the spot. “I thought this work sounded like a blast,” says Carson, now a mechanical engineer in Little Rock and director of Arkansas



Manufacturing Solutions. “You’re given a time constraint, a certain number of things to work with, and you have to figure out how to get to a solution.”

Not every decision made by scientists, engineers, or mathematicians is as dramatic as that which saved the crew of Apollo 13. But what these professionals have in common is that they spend their time solving concrete problems.

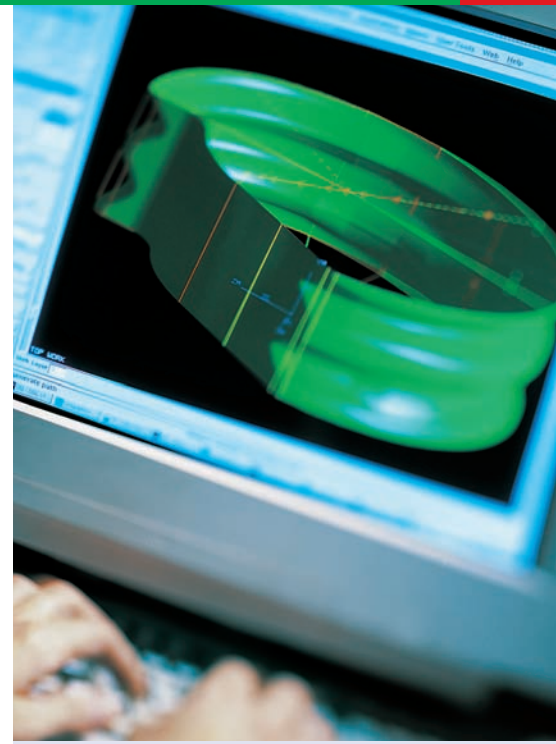
“You have to be patient,” says Ruth Jones, a NASA physicist who grew up in West Helena. Scientists are willing to see a problem through to the end, no matter how frustrating it might be. “And you have to have a love for math and science,” she adds.

Those who are good in those subjects thrive in the Science, Technology, Engineering, and Mathematics cluster. They’re curious about how things physically work: cars, computers, a volcano, chemicals, the human body.

Likewise, they like to solve problems with definite answers: math equations, word problems, chemistry formulas. They can analyze situations logically, break them down, and find solutions.

Engineers love the latest technologies and want to find new ways to use them: building rocket ships, faster planes, smaller computers, or medical equipment; or developing pollution-free energy sources. Being organized and able to work well with a team is also helpful.

Science careers often intersect with other careers, as well. Some people combine their interest in science with other talents to become teachers, doctors, entrepreneurs, or science writers. In the Science, Technology, Engineering, and Mathematics cluster, there are all sorts of possibilities, and you just might find one that’s a perfect fit. ●



## 10 Fastest-Growing Science and Engineering Professions

Occupation	Job Growth
1. Software Engineer	46.1%
2. Environmental Engineer	42.4%
3. Architect	24.1%
4. Industrial Engineer	23.6%
5. Metallurgical/Materials Engineer	20.5%
6. Aerospace Engineer	18.1%
7. Microbiologist	14.6%
8. Mechanical Engineer	14.3%
9. Drafting Specialist/Engineer	14.0%
10. Engineering Manager	13.2%

*Based on the expected percentage growth in the number of jobs in the career in Arkansas from 2002 to 2012. Source: Arkansas Department of Workforce Services*

For a sampling of careers in science, check out “25 Career Choices in Science and Engineering” on page 6.



## Test Yourself

Want to get a better idea of what jobs match your interests?

Visit the Arkansas Career Planning System online at [ark.kuder.com](http://ark.kuder.com). Based upon Arkansas' 16 career clusters (see "How Career Clusters Work," page 8) and powered by the Kuder Career Planning System, the Web site helps determine what kinds of jobs in which clusters would best suit you.

The system consists of three tests. One set of questions assesses your interests, another assesses your skills, and a third helps identify your personal values. Once you know yourself better, it's easier to identify the right career for you.

The system provides advice for preparing your Career Action Plan (see "Plan for Success") and information on your options for continuing your career preparation after high school.

It also lets you create and maintain an online portfolio listing the courses you've taken, the activities you have been involved in at school, and any special achievements you've accomplished. When you actually start searching for jobs, you can use your portfolio as a resume.

The system is available to students at more than 500 middle and high schools throughout the state and at all 22 of Arkansas' two-year colleges. Check with your guidance counselor to find out if your school participates in the program. If it does, your counselor will give you a special code that lets you enter the program when you go online.

# Plan for Success

*Every student needs a Career Action Plan (CAP). Here's how to create one that will get you off to a great start toward your chosen career.*

**W**hat do you want to do with your life? That can be a frightening question. You might dream about it, awed by the possibilities and freedom. Or perhaps you dread the future, afraid of the responsibilities and uncertainties. You might just shrug the question off, thinking there's plenty of time to worry about that later in high school or after you graduate. Why worry about it now?

You do have time to think about what you'll do after high school, but a little thought and planning now can help you find a career focus that will give your life meaning and fulfillment. Planning can prevent you from winding up at a job that makes your life dreary and miserable.

You don't need to map out your entire life right now, but it is smart to figure out a direction you'd like to go—and start moving that way. The first step is to devise a Career Action Plan—a map for your future.

Your CAP will help you make better decisions about what classes to take, what kind of education you might need after graduating from high school, what activities to get involved in, and which jobs to consider.

Every student entering high school should have a CAP covering the high school years to guide him or her through the maze of academic classes, career electives, and extracurricular activities.

You should revise your CAP every year, refining it to reflect your changing interests, goals, and desires.

"Career placement is a personal thing. It's not something you're completely locked into. Even grownups change their careers," says Susan Prater, an Arkansas public school program advisor. "It's never a place to stop. It's always a place to start."

Your teachers and counselors have developed the following step-by-step process to help you create your own Career Action Plan. Keep in mind that these steps are just a guide. You should read them carefully and apply what you learn to your particular interests and goals.

## Step 1: Complete Assessments

The first step in figuring out what kind of career you might enjoy is to get a better understanding of yourself—what activities you like and which ones you hate. Think about the kind of life you'd like to lead and your goals. Ask yourself questions such as: Do you want to work outdoors? With children? Do you like tinkering with machines? Or would you prefer a high-pressure job where you compete against others?

Several tools can help you figure these things out. These quizzes aren't the last word on the subject, but they can help you focus.

Many schools in Arkansas use Kuder (see "Test Yourself" at left) and ACT's Explore assessments. There are several of these questionnaires teachers might give you or you can take on your own.

The questionnaires will help pinpoint what you're interested in, what your skills are, and what things are important to you. The results shouldn't be all that surprising, but they will help you focus your search. Ask your teachers or counselors what assessment tools are available through your school.

## Step 2: Research Your Career Opportunities

Once you've identified your interests and talents, you should select some careers you think might fit best and learn more about them. You can research each of these careers on the Internet and at the library. Better yet, talk in person to people who work in these

fields to find out what their jobs are really like. Follow them around for a day to get a feel for what they do; this is called job shadowing. You'll want to know how much education or training is required beyond high school, what each job pays, and whether demand for people in the field is growing or shrinking. Some Web sites to help

you research the professions that interest you include [www.careerclusters.org](http://www.careerclusters.org), [www.discover.arkansas.gov](http://www.discover.arkansas.gov), and O\*NET ([online.onetcenter.org](http://online.onetcenter.org)). Ask your guidance counselor about ArkOTIS, another great career resource available on CD-ROM.

## Step 3: Explore Your Education Options

Once you've narrowed down the professions that might be a good fit for you, you need to know what education or training will be required to get you into them. Most jobs require some kind of education or training beyond high school, but that preparation could be anything from a stint in the military to a two-year degree from a technical school or community college or a bachelor's degree from a college, such as the University of Arkansas, to several years of advanced graduate work. When you have a better idea of the education requirements, you can prepare to meet them.

For instance, if you know you want to study engineering, you'll want to take as many advanced math classes as possible. Also consider Project Lead The Way

classes (see page 9), if your high school offers them.

You'll want to look for clubs, student competitions, and activities from which you can learn and get experience. And you can look for internships or part-time jobs that relate to the professions in which you're interested.



## Step 4: Talk About Your Options

Any good plan needs input from others. Talking with your parents, teachers, counselors, friends, and siblings is a good way to help refine your career plan and give you new ideas. Tell them about your career assessments, what you dream about doing when you're older, what you think you'd do well. They can help you research your choices and connect you with people who work in those professions, making it easier to do job shadowing and internships. The final decisions are yours to make—it's your life, after all—but it's smart not to go through the process alone. Take advantage of all the knowledge the people who care about you and your future can offer.

## Step 5: Document Your Choices and Progress

As you research your future and make choices, document your decisions. This will make it easier to review what you've done and help you visualize your journey. In eighth grade, you'll be asked to create

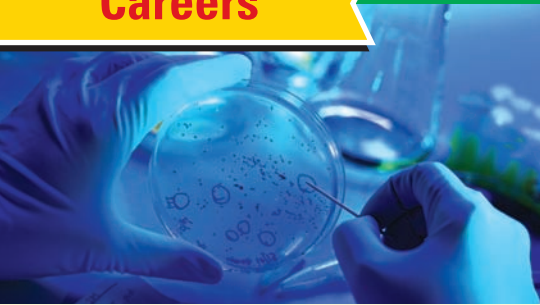
the CAP, which includes selecting a career cluster (see page 8). Included in the CAP might be the electives you plan on taking in high school, extracurricular activities in which you might get involved, training or education you plan on pursuing after high school, as well as your long- and short-term goals. The information will be kept in a folder at your school, to be reviewed each year. You won't be bound to the CAP for the rest of high school. You can switch to a different career cluster or pathway (an area of concentration within a cluster, as explained on page 8) whenever you want.

## Step 6: Review and Revise Your CAP

Whether you stick to the same cluster, it's important to revise your CAP at least once a year. Ask yourself: Do you like the decisions you made earlier? Have you accomplished what you wanted to so far? Do you have new dreams or plans you'd like to pursue? What went well and what went wrong in the past year, and why? Examining what you've done so far is a good way to prepare for the future. Changing your mind is okay and there's no shame in failing to meet some of your goals. Having an intentional plan, based on all the information you have at the time, will keep you from haphazard decisions that will end up making you unhappy. With a plan, you'll know what you're doing and why, and you'll have a goal for which to strive.

## Step 7: Graduate and Begin Your Work Life or Additional Education

When you graduate from high school, your career development won't be over. Most likely, it'll just be starting. You'll be able to apply your career planning skills as you enter college, begin technical training in the military or elsewhere, or search for employment. Even if you end up in a career much different from what you'd originally expected, the time you spent exploring your interests, talents, values, and goals will not have been wasted. ●



## About This Chart

At the right is a table of 25 jobs in the Science, Technology, Engineering, and Mathematics career cluster in Arkansas. The jobs are listed in order by income from the highest paid down. The fastest growing jobs are indicated by green arrows. These are only a sampling of the many well-paid, exciting jobs in science and engineering in Arkansas. To find out about other jobs, visit Discover Arkansas, the state Department of Workforce Service's online job library, at [www.discover.arkansas.gov](http://www.discover.arkansas.gov). Another great resource is Salary.com, which lists job information for every state in the country with specific listings for each city in the different states. Listed below are explanations of the symbols and abbreviations used in this chart.

### Abbreviations of Educational Requirements

**AD**—Two-year associate's degree  
**BD**—Four-year bachelor's degree  
**MA**—Master's degree  
**NA**—Information not available or item does not apply  
**DD**—Doctoral degree

### Symbols for Salary and Job Growth

★ The occupation is among the highest paid in the Science, Technology, Engineering, and Mathematics cluster in Arkansas.

▲ The occupation is one of the fastest growing in the Science, Technology, Engineering, and Mathematics cluster in Arkansas.

Sources for chart: Arkansas Department of Workforce Services and Salary.com

# 25 Career Choices

Occupation	Education Required <sup>1</sup>	AR Salary <sup>2</sup>	Job Growth <sup>3</sup>
Engineering Manager	BD, MA, DD	\$93,079 <sup>4</sup> ★	+13.2%
Astronomer	BD, MA, DD	\$79,795 <sup>4</sup> ★	NA
Conservation Scientist	BD, MA, DD	\$78,178 <sup>4</sup> ★	+7.5%
Meteorologist	BD, MA, DD	\$74,550 <sup>4</sup> ★	NA
Nuclear Engineer	BD, MA, DD	\$67,898 <sup>4</sup> ★	+1.8%
Environmental Engineer	BD, MA, DD	\$66,584 <sup>4</sup> ★	+42.4% ▲
Physicist	BD, MA, DD	\$65,923 <sup>4</sup> ★	NA
Chemical Engineer	BD, MA, DD	\$65,885 <sup>4</sup> ★	+7.7%
Metallurgical/Materials Engineer	BD, MA, DD	\$63,971 <sup>4</sup> ★	+20.5% ▲
Aerospace Engineer	BD, MA, DD	\$62,597 <sup>4</sup> ★	+18.1
Drafting Specialist/Engineer	AD, BD, MA	\$60,864 <sup>4</sup>	+14%
Ceramic Engineer	BD, MA, DD	\$58,976 <sup>4</sup>	NA
Software Engineer	BD, MA	\$57,056 <sup>4</sup>	+46.1% ▲
Electrical Engineer	BD, MA	\$56,978	+10.3%
Civil Engineer	BD, MA, DD	\$56,040	+9%
Mechanical Engineer	BD, MA, DD	\$55,480	+14.3%
Architect	AD, BD, MA	\$52,440	+24.1% ▲
Botanist	BD, MA, DD	\$49,385 <sup>4</sup>	NA
Mathematician	BD, MA, DD	\$49,100 <sup>4</sup>	+7.2%
Telecommunications Engineer	AD, BD	\$47,462 <sup>4</sup>	NA
Microbiologist	BD, MA, DD	\$47,273 <sup>4</sup>	+14.6%
Chemist	BD, MA, DD	\$46,636 <sup>4</sup>	+11.8%
Geologist and Geophysicist	BD, MA, DD	\$43,289 <sup>4</sup>	+0.9%
Biologist	BD, MA, DD	\$42,666 <sup>4</sup>	NA
Industrial Engineer	BD, MA, DD	\$36,810	+23.6% ▲



# in Science and Engineering

## Description

Plans and coordinates work in such fields as engineering and architecture, including research and development in these fields

Studies the solar system, planets, moons, stars, galaxies, and other space phenomena such as black holes

Studies the natural environment and ways to protect it from pollution and other potentially destructive forces

Studies the earth's atmosphere; conducts basic research and applies it in activities such as weather prediction

Devises ways to gain benefit from nuclear energy and radiation; designs and develops nuclear energy systems; monitors and operates nuclear reactors

Identifies, evaluates, and resolves problems with the environment; designs and maintains systems for determining levels of pollutants in the environment

Studies the laws of matter and energy and applies them to problems in science, engineering, medicine, and industry

Designs chemical plant equipment and develops processes for manufacturing chemicals and chemical products

Develops new metals and other materials to meet the special requirements of industry and manufacturers

Designs, develops, and tests aircraft, missiles, and spacecraft

Uses computer aided-design (CAD) to transform rough product designs into working documents; reviews engineering drawings to ensure that they meet specifications

Designs and supervises the construction of ceramic factories and the manufacture of ceramic products such as pottery, glassware, and heat-resistant materials

Designs, develops, writes, installs, and tests computer software programming applications

Designs, develops, and tests electrical components, equipment, and machinery

Designs and supervises the construction of structures and facilities, such as roads, airports, tunnels, bridges, sewage systems, and water supply systems

Designs and coordinates systems for the production, transmission, and use of mechanical power and heat

Plans and designs the construction of all types of buildings, including private homes, offices, hospitals, and schools

Studies plant life to discover its life processes, physiology, distribution, and economic value

Uses math for a variety of purposes, ranging from the creation of new theories to the solution of economic, scientific, and managerial problems

Installs, troubleshoots, repairs, and maintains telecommunications equipment

Identifies, isolates, and studies micro-organisms, bacteria, and their byproducts

Evaluates the chemical and physical properties of various organic and inorganic substances and investigates their applications to medicine and other industries

Studies the structure, composition, and history of the earth's crust; plays an important role in studying, monitoring, and cleaning up the environment

Studies the development, life processes, physiological structure, heredity, and distribution of plants and animals

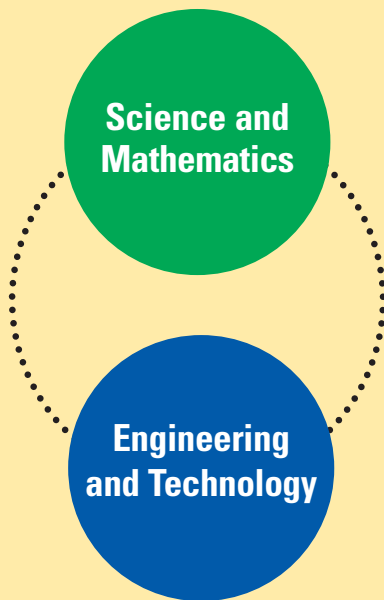
Determines the most efficient ways for an organization to use the basic elements of production—people, machines, materials, information, and supplies

<sup>1</sup> The minimum degree level required to enter the career; occupations may have different entry-level jobs for those with different degrees

<sup>2</sup> Median income per year, which means that half the people in the occupation in Arkansas earned more than the income listed and half earned less

<sup>3</sup> The expected percentage change in the number of positions in the occupation in Arkansas through 2012 (source: Arkansas Department of Workforce Services)

<sup>4</sup> Median income per year in Little Rock, Arkansas (source for salary and education information: Salary.com)



## Majors Clustered Under Science, Technology, Engineering, and Mathematics

Arkansas divides the Science, Technology, Engineering, and Mathematics cluster into two career pathways—two areas of study, like majors in college, that are more specialized (see the diagram above).

People in science and mathematics apply math and science to investigate problems, test solutions, and put the information generated to good use. Professions along this pathway include biologist, chemist, math teacher, physicist, and lab technician.

People in engineering and technology use advanced math as well as physical and life sciences to solve problems and design new technologies. This pathway includes all types of engineers, as well as technicians, drafters, and engineering professors. Each pathway of study gives you the particular education and training you'll need to reach your career goal.

# How Career Clusters Work

**C**areer clusters link the subjects you study in school and the things you like to do in your spare time with the things you might one day do to earn a living. Each cluster is a group of similar careers, made up of people with shared skills and interests. For instance, people who work in the Science, Technology, Engineering, and Mathematics cluster tend to be good problem solvers and curious about the way things work; those in the Arts, A/V Technology, and Communications cluster are creative and good communicators. Focusing on the career cluster that most interests you helps you best prepare for life after high school. You can always change your mind about your career plans and probably will. Even if you do, you can use the career cluster system to help focus your efforts as you explore career opportunities.

Here are the 16 clusters recognized in Arkansas:

- Agriculture, Food, and Natural Resources
- Architecture and Construction
- Arts, A/V Technology, and Communications
- Business, Management, and Administration
- Education and Training
- Finance
- Government and Public Administration
- Health Science
- Hospitality and Tourism
- Human Services
- Information Technology
- Law, Public Safety, and Security
- Manufacturing
- Marketing, Sales, and Service
- Science, Technology, Engineering, and Mathematics
- Transportation, Distribution, and Logistics

# PLTW Leads the Way

*Project Lead The Way shows students how applied science and math can lead to careers in engineering.*

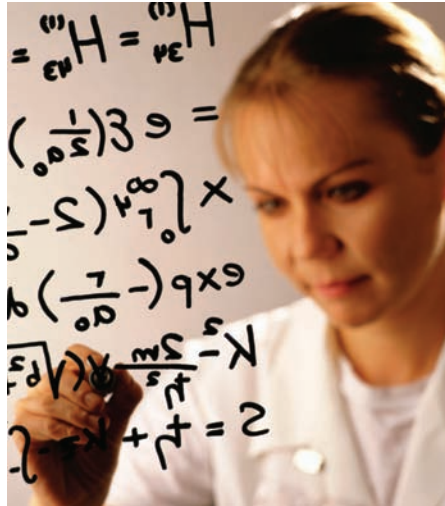
**M**ost high school classes teach basic subjects like math, grammar, history, or government. All of these things should be useful one day—theoretically. But just how you might use them isn't always clear.

Why in the world would you ever use differential equations or algorithms? Are you really ever going to need to add and subtract vectors or understand electric fields?

Project Lead The Way (PLTW) courses help Arkansas middle and high school students answer those questions. PLTW includes several introductory courses in engineering that show how basic concepts taught in the classroom are used in the work world. If you're thinking about a career in engineering, the classes are a great opportunity to explore how engineering really works.

"The classes are project-based, so the kids are not just reading and studying. They're performing," says Claire Small, who has been teaching Project Lead The Way classes for six years in Fayetteville and Springdale.

The classes give students a taste of what engineering work is like and help prepare them for the rigors of college study. More than half of the students in college engineering programs drop out before graduation. Studies show that



students introduced to engineering concepts and real-world problems in high school are better prepared for college engineering and more likely to be successful.

Middle school students undergo a basic introduction to the field; high school students go deeper, taking courses such as Digital Electronics, and Engineering and Design Development (see "The PLTW Core").

Students take these classes along with advanced math and science. In some schools, the classes count for college credit. The classes are now offered in more than 15 Arkansas schools, and the program continues to grow.

The classes are challenging but fun, Small says, and the technology used in the classes is first-rate. "It's really up-to-date compared to what's out there in the manufacturing world," she says. "You use what they're using in the industry—the software and the hardware."

Not everybody who takes the classes goes on to be an engineer, Small says. But everybody who takes them benefits from the skills learned. ●

## The PLTW Core

The number of students entering careers in engineering is going down, and the United States is losing its technological edge because of it. To increase interest in engineering, Project Lead The Way courses were developed to let students see what it's all about. Each of the classes are project-based, meaning the students don't just learn problem-solving skills, they put them to work doing fun projects. The PLTW core classes are

**Principles of Engineering:** This introductory class shows students how engineers apply math, science, and technology to solve problems and help people.

**Introduction to Engineering Design:** PLTW students learn how to use computer-modeling software to build and program products.

**Digital Electronics:** Using computer simulations, students learn how electronics work as they design, test, and construct various devices.



**Computer-Integrated Manufacturing:** Experimenting with robots and automated manufacturing tools, students learn more about the design and manufacturing process.

**Civil Engineering and Architecture:** Working in teams, students design community building projects.

**Engineering and Design Development:** Under the guidance of local engineers, teams of students research, design, and construct solutions to common engineering problems.

# Checking Out PLTW

*James Cope thought he'd give Project Lead The Way a try, and it was the best move he made in high school.*

**T**he way James Cope sees it, if you're thinking about a career in the Science, Technology, Engineering, and Mathematics cluster, you can't really go wrong taking Project Lead The Way classes.

"If Project Lead The Way is offered, definitely check it out," Cope says. "When you're in high school, there's no harm in looking into these programs.

"It's better for you to do it in high school than to go to college and decide engineering isn't for you after you've wasted a year in college.

"If you do like it, you've got a leg up. And if you don't like it—well, you don't like half your classes in high school anyway," he says.

Early on in high school, Cope thought he might want to study engineering or architecture in college. The summer

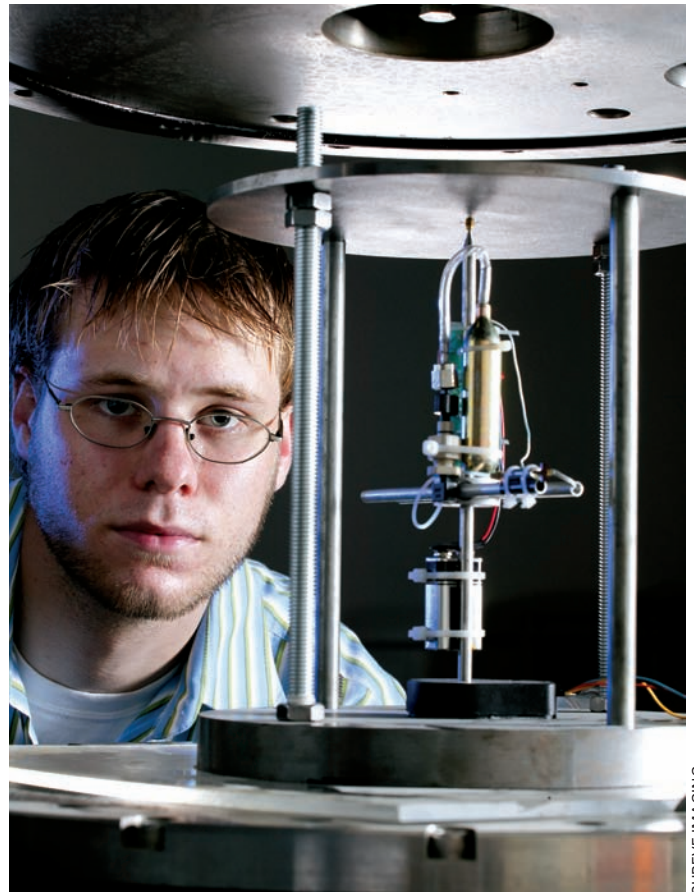
before his junior year at his high school in Fayetteville, he heard about a new program called Project Lead The Way. "I was like, 'Well, let's give this a try.' I got good vibes about it. So I signed up for the first class," he says.

It ended up being the best thing he could have done in high school, Cope says. He took four Project Lead The Way classes, and all of them helped him understand science and engineering better.

"I did not have a lot of engineering knowledge coming in to the Project Lead The Way classes. In my mind, mechanical engineers designed cars and that was it," he says.

The classes were also fun. In them, Cope built a marble maze to specifications, built a simulated traffic light, and programmed a vending machine. He programmed a milling machine to carve out his name on a piece of wood, and he also built a robot.

In 2002, he entered the University of Arkansas at Fayetteville, majoring in mechanical engineering. He says PLTW prepared him well for college. "There were things I did as a sophomore in college that I'd already done in Project Lead The Way," he says. "People had never heard of this stuff and I was like, 'Yeah, I did it in high school.'"



*James Cope poses with his NASA Work Force Development Scholarship project, a microthrust stand, at the University of Arkansas Engineering Research Center. Thrust is the force that drives rocket and jet engines forward. The microthrust stand measures thrust at extremely low levels.*

SHREVE IMAGING

## Engineer Shortage

Opportunities in engineering are strong because demand is high. According to the National Science Board, the number of engineering degrees earned by U.S. citizens has dropped from around 70,000 a year in the mid-1980s to fewer than 60,000 a year now.

If you think you might be interested in an engineering career, visit the PLTW Web site at [www.pltw.org](http://www.pltw.org).

Cope continues to stretch himself. In the spring of 2005, he went to work for Lockheed Martin in southern Arkansas as part of a school internship.

He's helping design a missile that will intercept incoming missiles. After he graduates, he plans to go to graduate school and expects eventually to work in the aerospace industry.

"I love getting to work with cutting-edge technology," he says. "It's fun. I love the technical aspects, I love being challenged, I love being presented with a problem and having to solve it. Engineers are the ones people look to when stuff goes wrong.

"And the money's not bad," he adds. ●

# Map a Pathway to Success

*Use the guides on the following pages to lay out a clear path to success in science and technology.*

**Y**our Career Action Plan (see “Plan for Success,” page 4) represents your first step down the pathway to your future. Like many first steps, it might be uncertain, a little wobbly, and perhaps even headed in a direction you don’t really want to go.

Like all first steps, however, it’s absolutely necessary, and it’s not going to wreck your life, no matter how wobbly. Once you get going, you have plenty of chances to change direction if needed. The important thing is that you get going now.



The pathway starts with the courses you take in high school. In the Science, Technology, Engineering, and Mathematics cluster, those courses will

differ depending on which career pathway you choose to take. In this cluster there are two defined pathways:\*

- **Science and Mathematics (page 12)**
- **Engineering and Technology (page 13)**

As you can see from the pathway maps on the next two pages, your high school classes are important parts of the plan, but they are not the only parts. Your pathway to a future in science and technology includes the high school activities in which you take part; your experiences in part-time jobs; your education after high school in a two-year college, four-year college, or training program; and even the jobs you eventually take as your career unfolds.

The learning never stops, really, and if you keep that in mind throughout your career, you’ll have an easier time. Each job you take is a learning experience that helps you re-evaluate what you’re doing and make sure your life and career are on the right track.

A perfectly straight career pathway would take you from your choice of, say, a science and mathematics course of study in high school, through a major in biology at a four-year college, and on to a career in biological research. If you find, however, that your pathway is more of a zigzag than a straight line, don’t worry. Most people reconsider their choices more than once in their lifetime and change careers as needed. That’s why you should revisit your CAP at least once a year to make sure it continues to reflect what you really want to do. ●

*\*Local Arkansas schools may organize clusters and pathways differently or use different names for the clusters and pathways they offer.*

## Arkansas’ Smart Core

Beginning with students entering ninth grade in 2006, all Arkansas students who intend to graduate from high school must complete the Smart Core of classes (unless their parents sign a waiver granting permission to participate in other courses). The Smart Core is a challenging set of classes offered now in Arkansas high schools that includes

- **Four units of English;**
- **Four units of math, including Algebra I, Geometry, and Algebra II;**
- **Three units of science with a lab, including Biology and Chemistry or Physics;**
- **Three units of social studies, including Civics/Government, World History, and American History.**



Smart Core obviously makes sense for students interested in careers in the Science, Technology, Engineering, and Mathematics cluster. Research shows that Smart Core benefits all students no matter what their career plans. Records indicate that Arkansas students enrolled in Smart Core post higher ACT scores. Students scoring higher on the ACT get higher grades in college and are more likely to complete four years of study and earn degrees.

## Career Major Map: Science and Mathematics

Professionals in science and mathematics do research to advance knowledge in their fields or apply math and science knowledge and skills to solve practical problems.

### Sample High School Schedule

9th Grade	10th Grade	11th Grade	12th Grade
Algebra 1 or Geometry	Geometry or Algebra 2	Algebra 2 or 3, Pre-Calculus/Trigonometry, Calculus, Statistics, or Computer Math	Algebra 3, Pre-Calculus/Trigonometry, Calculus, Statistics, or Computer Math
English 1	English 2	English 3	English 4
Civics 1 unit (or Civics 1/2 unit/Government 1/2 unit)	American History	World History	Elective
Physical Science	Biology	Chemistry	Physics
Physical Education 1/2 unit/Health & Safety 1/2 unit	Oral Communications 1/2 unit/Fine Arts 1/2 unit	Foreign language	Foreign language
Elective	Elective	Elective	Elective
<b>Recommended Electives</b>			
AP or International Baccalaureate (IB) mathematics or science electives			

### Out-of-Class Learning

Work-Based Learning Opportunities	Extracurricular Activities
<ul style="list-style-type: none"> <li>• Job Shadowing</li> <li>• Internship</li> <li>• Apprenticeship</li> </ul>	<ul style="list-style-type: none"> <li>• Wet &amp; Wild</li> <li>• Learning Tree</li> <li>• Gifted and Talented Scholars Program</li> </ul>

### After-High-School Options

Two-Year/ Associate's Degree	Four-Year/ Bachelor's Degree	Graduate Degree	Certification	Other
Examples: <ul style="list-style-type: none"> <li>• Biological Science</li> <li>• Physical Science</li> <li>• Mathematics</li> </ul>	Examples: <ul style="list-style-type: none"> <li>• Biology</li> <li>• Chemistry</li> <li>• Physics</li> <li>• Mathematics</li> </ul>	Examples: <ul style="list-style-type: none"> <li>• Biology</li> <li>• Chemistry</li> <li>• Physics</li> <li>• Mathematics</li> </ul>	Examples: <ul style="list-style-type: none"> <li>• Certified Drafter</li> <li>• Registered Laboratory Technician</li> <li>• Certified Consulting Meteorologist</li> <li>• Teacher Certification</li> </ul>	<ul style="list-style-type: none"> <li>• Military Service</li> </ul>

### Possible Occupations

- Biologist
- Chemist
- Economist
- Geneticist
- Laboratory Technician
- Mathematician
- Physicist
- Quality-Control Scientist
- Research Technician
- Science Teacher
- Statistician



# Career Major Map: Engineering and Technology

Professionals in engineering and technology apply concepts of mathematics, science, and technology to solve problems and develop new processes, facilities, and devices to improve people's lives.

## Sample High School Schedule

9th Grade	10th Grade	11th Grade	12th Grade
Algebra 1 or Geometry	Geometry or Algebra 2	Algebra 2 or 3, Pre-Calculus/Trigonometry, Calculus, Statistics, or Computer Math	Algebra 3, Pre-Calculus/Trigonometry, Calculus, Statistics, or Computer Math
English 1	English 2	English 3	English 4
Civics 1 unit (or Civics 1/2 unit/Government 1/2 unit)	American History	World History	Elective
Physical Science	Biology	Chemistry	Physics
Physical Education 1/2 unit/ Health & Safety 1/2 unit	Oral Communications 1/2 unit/ Fine Arts 1/2 unit	Foreign language	Foreign language
Introduction to Engineering Design <sup>1</sup>	Principles of Engineering <sup>1,2</sup>	Digital Electronics <sup>2</sup>	Engineering Design and Development <sup>2</sup>
<b>Recommended Electives</b>			
<p>1 Introduction to Engineering Design and Principles of Engineering may be taken in either ninth or 10th grade.</p> <p>2 Pathway options in addition to these courses: Computer-Integrated Manufacturing, Civil Engineering and Architecture, Biotechnical Engineering, Aerospace Engineering. Pathway options may be taken in 10th, 11th, or 12th grades.</p>			

## Out-of-Class Learning

Work-Based Learning Opportunities	Extracurricular Activities
<ul style="list-style-type: none"> <li>• Job Shadowing</li> <li>• Apprenticeship</li> <li>• Internship</li> </ul>	<ul style="list-style-type: none"> <li>• SkillsUSA</li> </ul>

## After-High-School Options

Two-Year/ Associate's Degree	Four-Year/ Bachelor's Degree	Graduate Degree	Certification	Other
Examples: <ul style="list-style-type: none"> <li>• Computer Information Systems</li> <li>• Electronics</li> <li>• Drafting and Design</li> </ul>	Examples: <ul style="list-style-type: none"> <li>• Computer Science</li> <li>• Mechanical Engineering</li> <li>• Civil Engineering</li> </ul>	Examples: <ul style="list-style-type: none"> <li>• Computer Science</li> <li>• Mechanical Engineering</li> <li>• Civil Engineering</li> </ul>	Examples: <ul style="list-style-type: none"> <li>• Certified Quality Engineer (CQE)</li> <li>• Certified Electronic Technician (CET)</li> <li>• Certified Drafter (CD)</li> </ul>	<ul style="list-style-type: none"> <li>• Military Service</li> </ul>

## Possible Occupations

- Aeronautical Engineer
- Architectural Engineer
- Biotechnology Engineer
- Chemical Engineer
- Civil Engineer
- Construction Engineer
- Drafter
- Electrical Engineer
- Mechanical Engineer
- Materials and Lab Supply Technician
- Quality Technician

# Welcoming Women

*Science, math, engineering, and technology are hot fields for women.*

**W**hen Ruth Jones started college, she planned on being an accountant. She was sharp with numbers, so accounting seemed like the kind of job she could do well. But her college algebra professor at the University of Arkansas at Pine Bluff, Dr. Muhammad A. Miah, saw she had the talent to do more than basic number crunching.

“He said, ‘You’re extremely good in math; you need to change your major to physics,’” Jones recalls.

Growing up in West Helena, Jones had

always been good at both math and science, but she’d never really given much thought to a career as any kind of scientist. After her professor’s prodding, Jones decided to give it a shot and switched majors. She quickly excelled in high-level math and science classes.

Jones became the first woman to earn a bachelor’s degree in physics from the University of Arkansas at Pine Bluff. She went on to graduate school at Alabama A&M University, where she earned her doctorate in physics and materials science in 2000 before she’d turned 30. She was

the second African-American woman in all of Alabama to earn a Ph.D. in physics.

Today she works as an optical physicist for NASA in Huntsville, Alabama, working on a Return to Flight project building a lens for a ground camera. Return to Flight is the effort to get the space shuttle program safely operating again after the Columbia disaster.

Many women have all it takes to be successful and groundbreaking scientists and engineers. In fact, women have been making vital

contributions to science for 5,000 years. Sadly, however, stereotypes persist. Few girls are encouraged to pursue science or math. Why?

“That’s a big issue that a lot of people have tried to answer,” says Pamela Jansma, a geology professor at the University of Arkansas at Fayetteville. “And it’s not clear why. From an early age, there’s this idea that women don’t do math or science.

“I don’t think it’s true. But the idea exists. My own daughter went through it,” she says. “She was very good at math, but she didn’t believe it. It came very easy to her. Now she wants to be a scientist. She’s in 10th grade now. But she went through a period in middle school when she didn’t think she could do it.”

The idea that women aren’t good at math or science is also hogwash to Kathleen Kisinger, a senior at Bryant High School. Kisinger has been taking Project Lead The Way (see page 9) pre-engineering classes throughout high school and is often the only girl in the class. Rather than finding it intimidating, she sees it as a challenge.

“I loved being the only girl. Guys tell you you’re not smart, and you kind of show them up,” Kisinger says.

Along with good-natured competition with the guys, Kisinger also has found friendship, sharing classes with many of the same students repeatedly. “We kind of grew up in the classes. You get used to having those people around you,” she says.

Kisinger says many of her girlfriends are just too intimidated to try the pre-engineering classes. Kisinger finds them challenging but not overwhelming—much as her male counterparts do. Mostly, she has had a lot of fun. She especially enjoys working with robots and computer simulation programs.

Fortunately for students such as



BRYAN BACON

*Ruth Jones, shown here reflected in a large aperture mirror, is an optical physicist with NASA working on the space shuttle program.*

Kisinger, there are more and more female role models in science, including engineer Claire Small, who, like a number of women scientists, sort of stumbled into her career. Her boyfriend's job involved soldering electronic breadboards, which intrigued her. "I thought to myself, 'This is kind of cool, and I'm tired of waiting tables.'"

She got a degree in electrical engineering and then worked for a number of different companies, including Texas Instruments and a New York company that built altitude control systems for satellites. She eventually moved into management. The money was good, but she and her husband decided that they wanted a simpler lifestyle. So they both became teachers and moved to Arkansas, where their families lived.

For the past six years, Small has been teaching PLTW engineering classes at Fayetteville and Springdale. Although the boys outnumber the girls by about two-to-one in her classes, the girls she teaches are just as bright. "I have just as many if not more girls who are good at it," Small says. "I don't see a dominant male versus female success ratio."

She says she doesn't know why more girls don't try science or math. "It seems like such a fun, cool thing to me, it's hard for me to understand why anybody wouldn't want to do it," Small says. "I don't think people start talking to girls soon enough about careers."

Although women may not be encouraged to go into the sciences, the field isn't hostile to their presence, says Arkansas engineer Lydia Carson. She got interested in engineering early on. "At the time, I didn't know any engineers. I just knew I liked math and science, and I didn't want to be a doctor," she says. "I went to the library and did some reading about engineering. It just seemed like you

could get a four-year degree and have a good, stable, job—and use math and science. It looked perfect."



Throughout her professional life, Carson has found the field of engineering welcoming. She now is the director of Arkansas Manufacturing Solutions, which provides engineering expertise to companies statewide, helping them improve their operations and become more competitive, and helping their employees earn industry certifications.

"It never even struck me as a gender issue at all. I personally didn't experience any pressure not to pursue it," Carson says.

Whatever the climate for women in mathematics, engineering, and science, Kisinger is not one to be deterred. She knows what she wants and loves the work and the challenge. She plans to study industrial engineering at the University of Arkansas in 2005.

Asked if she has any advice for girls thinking about tackling engineering, Kisinger responds: "Once you get into it, it's logical, and it all fits in. It's not so hard." ●

## Women Catching up to Men

Although men continue to outnumber women in science, engineering, and math professions, the percentage of women in these fields is growing steadily, according to the Association for Women in Science.

In 1975, women earned 33 percent of all bachelor's degrees in science and engineering. In 1998, they earned 49 percent. Every related field has seen substantial growth. The number of women earning bachelor's degrees in biological and agricultural sciences, for example, has more than doubled in those years, from 19,384 to 44,844.

Engineering degrees for women have climbed from 845 in 1975 to 11,339 in the late '90s—a more than 1,300 percent increase.

The number of science and engineering Ph.D.s earned by women has grown from 9 percent of the total in 1970 to 35 percent in 1999.

In 1973, women made up just 8 percent of the science and engineering workforce. In 1999, they made up 24 percent.

Unfortunately, women lag behind men in salary. Male engineers averaged \$92,600 a year in 2001, compared with \$80,000 for women. The gender gap in science and engineering salaries is significantly less than the gender gap in all jobs, however,



and it is narrowing. In some fields, including engineering, women at a certain level of experience make more than men.



## Education Options

Before you make final decisions about your plans after high school, you should look into all the educational choices Arkansas has to offer.

Technical institutes offer industry certification programs, many of which can have you certified and in the workforce in just one year. Learn more about the technical institutes at [dwe.arkansas.gov/TechInstitutes/ti.html](http://dwe.arkansas.gov/TechInstitutes/ti.html).

To check out two-year community colleges and technical colleges, visit the Arkansas Association of Two-Year Colleges site at [www.aatyc.org](http://www.aatyc.org). Click on Member Map for links to the state's two-year colleges.

Links to four-year and independent colleges are featured at the Arkansas Department of Higher Education's site at [arkansashighered.com/colleges.html](http://arkansashighered.com/colleges.html).

Web sites of Arkansas colleges feature information on admission, financial aid, courses offered, majors, and special programs. They can even give you some idea of what the campuses look like.

# Education Pays Off

*In science and technology, the more you learn after high school the more you earn throughout your career.*

**J**ay Hartman is operations manager for distribution for Entergy Arkansas, a large power company in the state. Among other duties, he manages the meter service department and monitors the company's electrical substations, making sure customers always have enough electricity.

"I like the credibility of being an engineer, the status, and responsibility," Hartman says. "The financial kickback from it is also nice."

There are lots of rewards to being an engineer, scientist, or mathematician. But

as long as you've got the interest in math and science, it's within your reach.

"Sometimes it's going to look like it's a little bit more than you can chew," Hartman says. "If it were easy, everybody would be doing it. But if you stick through the tough times, the reward will definitely outweigh the costs."

Typically, working engineers need at least a bachelor's degree from a college or university. Some people go on to get a master's or Ph.D., which generally leads to better-paying jobs with more responsibilities. However, many great jobs in science and technology require only a two-year degree from a technical school or community college. There are many pathways to careers in science. Here are some of your education options.

## Two-Year Colleges and Technical Schools

Arkansas has 22 two-year public colleges and technical schools at which you can earn associate degrees in science,

technology, and math. All offer the basic science and math classes you would take in the first two years at a four-year university or college—so if you decide to take your education further, your credits can transfer to a four-year school. The two-year colleges also offer associate's degrees



before you enjoy them, you'll have to pay your dues.

Getting the education to qualify for jobs such as Hartman's is demanding, but

that train people in fields, such as computer programming, networking, and maintenance, that can lead directly to good jobs.

Two technical institutes and Riverside Vocational Technical School in Grady offer valuable training, including industry certifications. Most programs can be completed in just one year. Admission is open to anyone age 17 or older.

## Four-Year Colleges

Arkansas' 23 four-year colleges and universities offer a number of first-rate programs in science and technology.

The University of Arkansas and Arkansas State University are active participants in the National Science Foundation's Research Experience for Undergraduates program (REU) in fields including astronomy, geosciences, biology, and chemistry. Undergraduate students accepted into these programs in their specialties do graduate-level research with leading scientists around the world.

The Arkansas Center for Space and Planetary Sciences at the University of Arkansas in Fayetteville is one of the



foremost institutions for space research and science. The University of Arkansas is also strong in engineering, with its industrial and civil engineering programs ranking among the country's best.

## Military

If you don't think college is for you or if you feel you're not quite ready, the U.S.

military is a great place to get marketable training in a number of science and technology fields. The military even helps pay for college later on.

The military works with the latest technologies, many of which were invented specifically for the armed forces.

You'll receive top-notch training and might even be able to earn college credits while you're serving.

Benefits vary among the service branches. For more information, check out these Web sites: [www.goarmy.com](http://www.goarmy.com) (Army); [www.navy.com](http://www.navy.com) (Navy); [www.airforce.com](http://www.airforce.com) (Air Force); [www.marines.com](http://www.marines.com) (Marines); and [www.uscg.mil](http://www.uscg.mil) (Coast Guard). ●

## Finding Financial Aid

Applying to a university can be an intimidating experience. Never mind how hard getting a degree might seem—the cost alone can be scary, ranging anywhere from \$2,000 to \$30,000 a year. Luckily, there is lots of help available in the form of grants, scholarships, work-study programs, and low-interest loans. The state of Arkansas provides about \$45 million a year in financial aid to students in higher education. Much more is available at the federal level.

Jay Hartman, an electrical engineer in Little Rock at the power company Entergy Arkansas, got some scholarship money and worked part-time to pay for his education. He stresses the need to be thorough and follow through in your financial aid search. "Nobody is going to give you anything unless you apply," he says.

It's also important to build the best academic record possible. The state of Arkansas awards scholarships on a sliding scale, based on grade-

point average (GPA), ACT scores, and family need. Awards begin with the Academic Challenge Scholarship at \$3,000 a year for an approved state college or university. With a higher GPA and ACT score, the Governor's Scholar Program awards \$4,000 a year. A 32 ACT score and a 3.5 GPA qualifies students for \$10,000 a year.

You can get an overview of other state aid programs at [www.arkansashighered.com](http://www.arkansashighered.com). Individual colleges offer specific financial aid packages, so check directly with the schools you might like to attend, as well.

Check out organizations with which you or your family have a connection. Is your granddad a member of the local Kiwanis Club or Rotary Club? Many of these organizations offer scholarships through their local or national offices. Churches,



synagogues, and mosques also offer financial aid to their members.

When you apply for aid, says Hartman, perfect your application and shoot for the moon. "Apply as much as you can," he recommends. "Don't limit yourself to one or two applications. Do your homework and turn in a complete application."

It pays to give this project your best shot. "The money is not going to come up and just hit you in the face," Hartman says.



## Special Programs

Two Arkansas programs are designed to encourage the academic skills needed to succeed in science, technology, engineering, and mathematics.

The Arkansas School for Mathematics, Sciences, and the Arts in Hot Springs was set up for high school students who are interested in math, science, and the arts. Since 2004, it has been part of the University of Arkansas system. Tuition is free, the maximum enrollment is 300, and students in grades 11 and 12 live on campus. Visit [asmsa.net](http://asmsa.net) for more information.

High school students in the four-county area of northwest Arkansas (Benton, Carroll, Madison, and Washington counties) can participate in the Academy for Mathematics and Sciences. This special college preparation program is designed to encourage students to study math or science in college. The program is open to students in grades nine through 12. Students in the program take special classes in their own schools throughout the year and attend a six-week summer session at the academy. Go to [ubets.uark.edu/ubms/home.php](http://ubets.uark.edu/ubms/home.php) for more details.

# Get On-the-Job Experience Now

*Start learning about science and technical careers in real-world offices and labs.*

If you want to land a dream job that is a blast to do, pays well, and gives your life meaning, you've got to do more than just show up for class and study hard. Thousands of students graduate from high school in Arkansas every year, and many of them want the same kind of job you do.

Fortunately, there are lots of ways—internships, part-time jobs, student

education more meaningful. They'll help you identify what kind of career you want to have. And they'll give you a leg up when you apply for training programs, scholarships, colleges, and jobs.

## Job Shadowing

You can get started right away. Do you think you might like to be a geologist, meteorologist, or civil engineer when you get out of school? Well, one of the best ways to learn more about those and other professions is to watch someone already working in the profession for a day. Job shadowing will give you a good idea of what a typical workday is like and whether you'd enjoy the profession.

In Arkansas, students begin job

shadowing in eighth grade and aim to complete four job shadows by the time they finish high school. You don't have to wait for your school to arrange a job shadow, however. Check with your guidance counselors, teachers, parents, or family friends to find an opportunity



in a profession in which you're interested.

groups, competitions, and volunteer work—to set yourself apart from everyone else and get valuable experience in technical or scientific work. You could find an internship or a part-time job that puts you out in the woods taking water and soil samples, in a laboratory doing tests, or at a computer helping engineers design cutting-edge technology.

These experiences outside the classroom can be fun and will make your

## Youth Apprenticeship Program

In Arkansas, you can start getting work experience and credits for your postsecondary classes before you even graduate, through the state's Youth Apprenticeship Program. A number of the state's high schools have partnered with technical colleges and businesses to offer

technical training and on-the-job apprenticeships in several different fields.

In the Science, Technology, Engineering, and Mathematics cluster, that includes careers such as drafting and design, electronics, computer networking and diagnostics, and geographic information systems (GIS), among others. Students who enroll in the program agree to continue their education beyond high school at one of the participating community colleges or technical schools.

## Internships

If you've completed two classes in a specific career pathway (science and mathematics, for example), you can participate in your high school's internship program during your junior or senior year. This program places students with local employers doing work related to the pathway. The program is designed to put you in real-life learning experiences to complement what you've been learning in class.

Many large businesses hire interns, who often work full time over the summer. If you are a woman or a member



of a minority group, you might want to check out the National Aeronautics and Space Administration's (NASA's) Summer High School Apprenticeship Research Program (SHARP). This internship program was organized to help bring groups of workers who have been underrepresented in science into the field. SHARP is held each year at 13 NASA facilities and at selected universities. You can learn more about the program at [www.mtsibase.com/sharp](http://www.mtsibase.com/sharp).

## Part-time or Volunteer Work

If a company near you does the kind of work you want to do when you get out of school, why not see if it could use some part-time paid help? Or see if you can help out a few hours a week for free.

If you want to be a botanist, there may be a plant nursery nearby. Or if you'd like to be an industrial engineer, check out local factories at which you could work. If you want to be a meteorologist, a nearby National Weather Service station might have some work for you.

Even if you just end up making photocopies or being a gofer, you'll get an inside view of the jobs. And you'll get to know professionals in the field who can teach you a thing or two and maybe one day write you a recommendation for a university, scholarship, or job. These contacts can make a big difference in your future. ●



## Student Competitions

Student competitions and organizations are a great way to apply what you've learned in the classroom on a project that is educational and fun. They'll also teach you how to work in a team and communicate your ideas to others. And you might even get to travel to national events where you can meet with other students and scientists from universities around the country. College representatives recruit a lot of students at these regional and national competitions.

These are three of the main competitions for Arkansas students.

- **SkillsUSA** has more than 13,000 chapters in high schools and colleges across the country. Chapter members carry out service projects and prepare for competitions sponsored at the local, state, and national levels. At national competitions, thousands of students compete in events, including animation, automotive technology, manufacturing, carpentry, electronics, and Web design, among many others. Most Arkansas high schools are active in SkillsUSA. For more information, check out [www.skillsusa.org](http://www.skillsusa.org).

- **FIRST High School Robotics Competition** is a national competition of teams of high school students (sponsored and assisted by a local company) who design and build robots to do a specific task. The national competition to design the best robot awards more than \$3 million in scholarship money. For more information, see [www.usfirst.org](http://www.usfirst.org).

- **Arkansas State Science Fair** is a competition of students across the state in several science and technology events for cash prizes of as much as \$1,000. Held every April, the event is sponsored by the Arkansas Science Fair Association. Winners at the state fair compete at the Intel International Science and Engineering Fair held each May. For more information, go to [www.uca.edu/org/assfa](http://www.uca.edu/org/assfa).



## Information Jackpot

These sites are treasure troves of career planning information.

### America's Career InfoNet, [www.acinet.org](http://www.acinet.org)

This site includes full information on specific careers in Arkansas, your educational options, and more than 5,000 sources of financial aid.

### Arkansas Career Planning System, [ark.kuder.com](http://ark.kuder.com)

This online tool helps you determine the kind of work life and the careers that might suit you best. The free service, which is available to Arkansas students both at school and at home, is provided by the Arkansas General Assembly, Department of Workforce Education, Department of Education, Department of Higher Education, and Arkansas Association of Two-Year Colleges.

### Arkansas Next: A Guide to Life After High School, [www.arkansasnext.com](http://www.arkansasnext.com)

This useful site provides practical information and advice on getting an education after high school graduation, finding a job, even managing your money and avoiding credit card debt. It's a consumer's guide to postsecondary life.

# Ready Resources

*These handy resources can help you find the career pathway that's right for you.*

**W**ith a virtual library at your fingertips on the World Wide Web, you can run down all the facts necessary for successful career planning. Here are some of the best sources\* of information.

## On Science, Technology, Engineering, and Mathematics Careers

- Arkansas State Science Fair, [www.uca.edu/org/assfa](http://www.uca.edu/org/assfa)
- Association for Women in Mathematics, [www.awm-math.org](http://www.awm-math.org)
- Association for Women in Science, [www.awis.org](http://www.awis.org)
- Careers in Science and Engineering, [www.nap.edu/readingroom/books/careers](http://www.nap.edu/readingroom/books/careers)
- National Academies, [www.nationalacademies.org](http://www.nationalacademies.org)
- National Science Foundation, [www.nsf.gov](http://www.nsf.gov)
- Project Lead The Way, [www.pltw.org](http://www.pltw.org)
- Sloan Career Cornerstone Center, [www.careercornerstone.org](http://www.careercornerstone.org)
- Vocational Information Center Engineering and Science Career Resources, [www.khake.com/page53.html](http://www.khake.com/page53.html)

## On Planning Your Career Inside Arkansas

- Arkansas Association of Two-Year Colleges, [www.aatyc.org](http://www.aatyc.org)
- Arkansas State Colleges and Universities, [arkansashighered.com/colleges.html](http://arkansashighered.com/colleges.html)
- Arkansas Department of Education, [arkedu.state.ar.us](http://arkedu.state.ar.us)
- Arkansas Department of Higher Education, Financial Aid, [www.arkansashighered.com/financial.html](http://www.arkansashighered.com/financial.html)
- Arkansas Department of Workforce Education, [dwe.arkansas.gov](http://dwe.arkansas.gov)
- Arkansas jobs.net, [www.arkansasjobs.net](http://www.arkansasjobs.net)

## Outside Arkansas

- American Careers, [www.carcom.com](http://www.carcom.com)
- Bureau of Labor Statistics Career Information, [www.bls.gov/k12](http://www.bls.gov/k12)
- Campbell Interest and Skill Survey, [www.iproduction.com/mot\\_dem/ciss1.htm](http://www.iproduction.com/mot_dem/ciss1.htm)
- Career Interests Game, [career.missouri.edu](http://career.missouri.edu)
- Career Key, [www.careerkey.org/english](http://www.careerkey.org/english)
- College Board, [www.collegeboard.com](http://www.collegeboard.com)
- Holland's Self-Directed Search, [www.csp.msu.edu/pages/qg/sds.cfm](http://www.csp.msu.edu/pages/qg/sds.cfm)
- Keirsey Temperament Sorter, [keirsey.com](http://keirsey.com)
- Mapping Your Future, [www.mapping-your-future.org](http://www.mapping-your-future.org)
- Myers-Briggs, [www.knowyourtype.com](http://www.knowyourtype.com)
- Occupational Outlook Handbook, [www.bls.gov/oco](http://www.bls.gov/oco)
- O\*NET Online, [online.onetcenter.org](http://online.onetcenter.org)
- The Princeton Review, [www.princetonreview.com](http://www.princetonreview.com)

*\*Web site addresses were correct at the time of publication but may have changed since then. If you cannot reach the site you're looking for, use an Internet search engine to find the current address.*

# Career Definitions

*To really take charge of your career quest, you need to understand the language of career education.*

**Apprenticeship:** a learning experience in which a paid worker new to a job undergoes an organized program of classroom instruction and on-the-job training leading to certified mastery of the craft

**Assessment:** a test usually designed to document skills, interests, or values; assessments are used in career education to help students decide which careers might be best for them

**Associate's degree:** a degree acquired after high school through completion of a two-year course of study, usually at a community or technical college

**Bachelor's degree:** a degree acquired after completion of a four-year course of study, usually at a college or university

**Career Action Plan (CAP):** a plan drawn up by students at the beginning of high school for in-class instruction, student activities, and work-based learning through graduation; students review their CAPs regularly as they go through school and revise them as needed

**Career clusters, career cluster system:** a system for career education that classifies careers into 16 broad groups called clusters (such as Information Technology or Science, Technology, Engineering, and Mathematics) and organizes education around preparation for careers in particular clusters; students also pick **career pathways** within their clusters that lead to specific occupations

**Career major:** a course of study within a career cluster designed to help prepare high school students for particular occupations; also called a **career pathway**

**Career pathways:** narrower courses of study within career cluster systems that steer students toward particular careers; also called **career majors**

**Certification:** an educational credential earned through a course of study and work-based learning designed to produce mastery of a particular skill

**Cooperative education:** a learning arrangement in which classroom career instruction is coordinated with work on the job



**Curriculum:** a set of coursework designed to lead to a particular educational goal

**Internship:** a working and learning arrangement in which students hold temporary jobs in their chosen career field, usually under the guidance of an on-the-job **mentor**

**Job shadowing:** an out-of-the-classroom learning experience in which students learn about particular jobs by following professionals in the jobs as they make their way through a day at work

**Master's degree:** a degree usually acquired after completion of additional study after graduation from a university and often after preparation of a long, written study called a thesis

**Mentor:** an older, more experienced person who helps someone new to a job learn how to do it

**Ph.D. (doctor of philosophy):** a degree earned following additional study after graduation from a university (often after earning a master's degree) and usually after preparation of a long, written study called a dissertation

**Project Lead The Way:** an innovative program of courses offered in middle school and high school to introduce students to the concepts of engineering

**Work-based learning:** learning that takes place outside the classroom, on the job, at real places of business; examples include **internships**, **apprenticeships**, and **job shadowing** ●

# Arkansas' Career Clusters



Processing, production, distribution, financing, and development of agricultural commodities and natural resources



Designing, managing, building, and maintaining the built environment



Creating, exhibiting, performing, and publishing multimedia content



Organizing, directing, and evaluating functions essential to productive business operations



Providing education and training services and related learning support services



Planning finances and investments and managing banking, insurance, and business finances



Executing governmental functions at the local, state, and federal levels



Providing diagnostic and therapeutic services, health informatics, support services, and biotechnology research and development



Managing restaurants and other food services, lodging, attractions, recreation events, and travel-related services



Providing for families and serving human needs



Designing, supporting, and managing hardware, software, multimedia, and systems integration



Providing legal, public safety, protective, and homeland security services



Processing materials into intermediate or final products



Performing marketing activities to reach organizational objectives



Performing scientific research and professional technical services



Managing movement of people, materials, and goods by road, pipeline, air, rail, and water

**Note:** Local Arkansas schools and districts may choose to use fewer career clusters, clusters that are organized differently, or clusters with alternative names. Logos used with the permission of the National Association of State Directors of Career and Technical Education Consortium.